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09/940,917

08/28/2001

Gurtej Singh Sandhu

303.676US2


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07/18/2002

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.  
P.O. BOX 2938  
MINNEAPOLIS, MN 55402

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|  | EXAMINER |
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VOCKRODT, JEFF B

| ART UNIT | PAPER NUMBER |
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2822

DATE MAILED: 07/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/940,917

Applicant(s)

SANDHU ET AL.

Examiner

Jeff Vockrodt

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 28 August 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 44,45 and 60-83 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 44,45,60,62-64,66-68,70-72,74-77,79-81 and 83 is/are rejected.
- 7) ☒ Claim(s) 61,65,69,73,78 and 82 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### DETAILED ACTION

This office action is in response to the preliminary amendment filed on 8-30-01. Claims 44-45 and 60-83 are pending.

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

**Claims 44, 60, 62-64, 66-68, 70-72, 74-77, 79-81, & 83 are rejected under 35**

**U.S.C. 102(e) as being anticipated by U.S. Pat. No. 5,725,739 ("Hu").**

Claims 44, 60, 64, 68, 72, 77, & 81. Hu teaches a metal filled high-aspect ratio contact comprising:

a silicon substrate 310;

a transistor on the silicon substrate having a source/drain region (col. 2, ll. 19-32);

a borophosphous silicate glass (BPSG) layer 312 over the substrate 310;

a titanium silicide alloy layer 356 (titanium alloyed with silicon) within a high-aspect ratio contact opening 314 in the BPSG layer 312; and

a titanium silicide contact 354 coupled to the alloy layer 356.

Claims 62, 66, 75-76 & 79-80. BPSG contains SiO<sub>2</sub>.

Claims 63, 70, & 74. "source/drain" as noted above necessarily refers to part of a transistor.

Claims 67 & 71. The contact is high aspect ratio as discussed above.

Claim 83 is a product-by-process claim, and, as such, is only limited by the structural limitations of the claim and the structure implied by the process limitations of the claim. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985). In this case, a structure formed by combining a titanium containing precursor with a seed layer, i.e. CVD, in the claimed manner does not structurally distinguish from the product of Hu, which is formed using a sputtering process. Claim 83 is alternatively rejected under 35 USC §103 infra.

**Claims 44, 60, 62, 68, 71, 72, 75-76, & 83 are rejected under 35 U.S.C. 102(a,e) as being anticipated by U.S. Pat. No. 5,644,166 ("Honeycutt").**

Claims 44, 60, 68, & 72. Honeycutt teaches a sacrificial germanium layer for formation of high-aspect ratio submicron VLSI contacts wherein the device comprises:

a silicon substrate 12;

a transistor on the silicon substrate having an active region 14;

a BPSG layer 16 over the substrate 12;

a titanium-germanium-silicide contact within a high-aspect ratio contact hole in the BPSG layer 312. The claimed titanium alloy layer on a titanium silicide layer does not distinguish over the titanium-germanium-silicide layer because they are formed the same way.

Claims 62 & 75-76. BPSG contains SiO<sub>2</sub>.

Claim 71. The contact is high aspect ratio as discussed above.

Claim 83. The germanium layer 40 is deposited by LPCVD and the titanium layer is deposited by sputtering or CVD (col. 7, ll. 29-32).

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**Claims 44-45 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Pat. No. 5534716 ("Takemura").**

Takemura teaches a thin film transistor. Takemura teaches adding Ti and Zn to amorphous silicon films to promote crystallization for forming silicon active layers (col. 2, ll. 26-37). Takemura teaches depositing a titanium layer on regions of the silicon active layer and annealing to produce a titanium silicide film (col. 11, ll. 60-65). The resultant structure is a titanium and zinc containing layer adjacent a titanium silicide layer.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 44, 60, 62-64, 66-68, 70-72, 74-77, 79-81, & 83 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. 5,644,166 ("Honeycutt") in view of U.S. Pat. No. 5,049,975 ("Ajika").**

Claims 64, 77, & 81. Honeycutt teaches the high-aspect ratio contact structure as discussed above with relative to claims 44, 60, 62, 68, 71, 72, 75-76, & 83. Honeycutt teaches a contact coupled to an active region of a VLSI circuit, but does not specifically teach making contact to a source/drain region. Honeycutt is an improvement over a conventional silicide contact that is formed by depositing a titanium layer and later annealing to form a titanium silicide layer at the bottom of the contact hole. Honeycutt teaches that spiking and wormholes can be avoided.

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Ajika teaches a titanium silicide contact to the source/drain region of an EEPROM access transistor wherein a titanium layer is deposited over a contact opening and later annealed to form a titanium silicide layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to form the contact of Honeycutt on a source/drain region of an access transistor such as taught by Ajika to avoid spiking and wormholes.

Claims 66 & 79-80. BPSG contains SiO<sub>2</sub>.

Claims 63, 70, & 74. "source/drain" as noted above is a refers to part of a transistor.

Claims 67. The contact is high aspect ratio as discussed above.

**Claim 83 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hu.**

Hu teaches a metal filled high-aspect ratio contact as applied to claims 44, 60, 62-64, 66-68, 70-72, 74-77, 79-81, & 83. Claim 83 was rejected as being anticipated by Hu.

Alternatively, should the foregoing ground of rejection be deemed improper under 35 USC § 102, the claim is rejected under 35 USC § 103. Hu does not teach certain process limitations that are part of a chemical vapor deposition process. Hu forms the contact using a sputtering process and not a chemical vapor deposition process. The product of Hu, however, appears to be the same as the claimed product.

"Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985) (citations omitted). A "product by process" claim is directed to the product per se, no matter how actually made, In re Hirao and Sato et al., 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also In re Brown and Saffer, 173 USPQ 685 (CCPA 1972); In re Luck and Gainer, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and In re Marosi et al., 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a "product by, all of" claim, and not the patentability of the process, and that an old or obvious product, whether

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claimed in "product by process" claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

***Allowable Subject Matter***

Claims 61, 65, 69, 73, 78, & 82 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:


Claims 61, 65, 69, 73, 78, & 82 each require a titanium alloy layer within a contact opening in an insulating layer comprising titanium and zinc and having a titanium silicide contact coupled to the layer. None of the references of record teach or suggest a titanium alloy layer within a contact opening in an insulating layer comprising titanium and zinc and having a titanium silicide contact coupled to the layer. Neither Hu nor Honeycutt teach or suggest compositions including zinc. While Takemura does teach a zinc composition, it is restricted to an active layer and is not within a contact opening in an insulating layer.

Any inquiry concerning communications from the examiner should be directed to Jeff Vockrodt at (703) 306-9144 who can be reached on weekdays from 9:30 am to 5:00 pm EST. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at (703) 308-4940.

The fax numbers for this Group are (703) 305-3432, (703) 308-7722, (703) 305-3431, and (703) 308-7724. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist at (703) 308-0956.

July 15, 2002

J. Vockrodt



CARL WHITEHEAD, JR.  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800